



▲ Home

◀ Contents

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### **Student Learning Styles/Strategies and Professors' Expectations: Do they match?**

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#### **Abstract**

University students may not always learn in ways that match those that professors use in their teaching. Third-year students at a small, mainly undergraduate, Canadian university showed a wide variety of approaches when tested with Kolb's (1976) Learning Style Inventory. Students in the Humanities were the most varied, and those in Health Science and Science tended to the practical Active Experimentation (learning by doing) approach. Those in the Sciences often used the data analysis based Strategy of Convergers, especially males, who lived up to their stereotype and seldom used the affective approach of Divergers. Professors' course outlines de-emphasized the Concrete Experience (sensing/feeling) Style and affective based Diverger Strategy far more than students, and often asked for the bottom-up objective evaluation of Reflective Observation, as exemplified by quantitative tests. For both genders and across four Faculties, the diversity of student approaches to learning was the most striking finding.

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#### **Introduction**

One of the drawbacks of the lack of teacher training given to instructors in post-secondary education (Wulff & Austin, 2004) is that most arrive in the middle of the process without knowing much about how teaching and learning work. In his discussion of multiple intelligences, Gardner (1983) mentions that standard instruction focuses on two of many cognitive skills, linguistic and logico-mathematical, and that it also 'decontextualizes' learning by removing it from practical circumstances. This narrow focus is unfortunate because education should prepare individuals for real-world situations, which are best solved with multiple approaches, tools and collaborations to accomplish the goals (see Conference Board of Canada Employability Skills, n.d.) Not only do these real world situations require a variety of styles, (Coker, 1995) but students also come to post secondary education with a variety of approaches to learning (Piane, Rydman & Rudens, 1996; Vermunt & Vermetten, 2004; Wolfe, Bates, Manikowske & Amundsen, 2006). One teaching style is therefore not going to fit all students. Clearly, accommodation of differences between teacher and student styles could be minimized either by teacher accommodation (More, 1993) or student changes or choices (Vermetten, Vermunt & Lodewijks, 2002), and identifying and integrating these styles may provide the students with the best possible learning experience (More, 1993). Yet few studies have looked widely across disciplines at how student approaches to learning vary (Hativa & Birenbaum (2000) compare Education and Engineering, for instance) and how they match professorial teaching methods and expectations (Wolfe, Bates, Manikowske, & Amundsen, (2005) and Crews, Stitt-Gohdes, & McCannon, (2000) look within

management, and Piane et al (1996) look at graduate students in Public Health).

Learning strategies, defined as combinations of cognitive skills implemented when a situation demands learning (Vermunt & Vermetter, 2004), are measured in different ways. Learning styles, in contrast, can be regarded as the way in which one first approaches the information to be evaluated and learned. Since learning styles affect comprehension, classroom performance, study strategies and exam writing techniques (Miller, 2001), they can be regarded as a route into learning strategies. Everyone may end up with the same mastery but they may not have used the same technique to get there. Kolb (1976; 1999) developed his four-quadrant approach to learning based on the assumption that there are two differences in how people learn: how they perceive information (Styles) and how they process it (Strategies). He felt that learners could be divided into four groups. For instance, faced with the puzzle of schizophrenia, the Concrete Experimentalists (sensing/feeling) might want to meet with people with the disorder, find out how individuals cope with it and build ideas about coping with mental illness. The Reflective Observer (watching) might read the Schizophrenia Bulletin to find out everything about the illness. The Abstract Conceptualizer (thinking) might take the occasion to theorize about the example of how environment and heredity lead to mental illness, whereas the Active Experimentalist (doing) might volunteer at the Schizophrenia Society and educate the general public about mental illness (see **Figure 1**). Combinations of these styles could lead to Assimilator, Accomodator, Converger or Diverger strategies. As an Accommodator combines sensing/feeling with doing, s/he might in this case start a drop-in program for consumers with the illness.

One reason to be concerned with such learning styles is that they are assumed to dominate both particular areas of learning (Wolfe, et al., 2006; Hativa & Birenbaum, 2000) and to differ by gender (Ackerman, Bowen, Beier & Kanfer, 2001; Brew, 2002). An example of this division is that scientists, who are predominantly male, presumed to be objective, data based and calculating, are categorized in the Converger group. Differential access to scientific careers is the result in part of the opposite categorization of females as intuitive and reflective Diversers (Bem, 1981). Thus, despite the closing of the gap in mathematical ability over the past few decades (Hyde & Plant, 1995), females both self-select and are selected out of this intellectual area (Etkowitz, Kemelgor & Uzzi, 2000). In addition, teaching styles of instructors vary depending again on area (see Richardson (2005) for Physics) and their own cognitive style (Evans, 2004). As students learn better when their styles are accommodated (Dunn, Griggs, Olson, Beasley & Gorman, 2001), how do we find a fit from all this?

The answer to this question must start with observation. It is relatively easy to give students in different Faculties a test of their approaches to learning, to see both whether there are dominant styles and strategies by area and whether these are gender-biased. In order to see whether their dominant learning style matches professors' expectations, course outlines (which are to some extent a contract about instruction with students) can be assessed to evaluate what learning styles are expected of them. These are the two goals of the present study.

## Materials and Methods

### Subjects

Subjects were undergraduate students at the University of Lethbridge enrolled in third year classes (some would be second or fourth year but they averaged third year). There were 97 students in Health Sciences (87 female, 10 male), 135 in Sciences (79 female, 56 male), 107 from Management (45 female, 62 male) and 97 from Humanities (57 female, 40 male). Social Science was omitted because it tends to be a heterogeneous 'boundary area'. Because there were fewer Health Sciences majors, students from Lethbridge College who were taking third year Health Science courses were also evaluated to balance the numbers.

### Methods

For student recruitment, professors from a wide variety of areas were approached for permission to test the students in their third-year classes. When such permission was given, class members were asked to fill out the Kolb Learning Style Inventory (1999), giving their ranking of four possible completions of 12 different sentences indicating their learning preference (see [Figure 1](#)). The students themselves then computed their dominant learning style from the four of Feeling (CE), Listening/watching (RO), Thinking (AC) and Doing (AE) and listened to a short discussion of what that might mean to them. Then the tests were collected for analysis of learning.

### Learning Styles Strategies.

Course outlines of third-year courses from a variety of areas in the four Faculties involved were downloaded from the web and examined for suitability, with the basic criterion that there was enough information on use of learning styles in assignments. When outlines were chosen, professors were then contacted for permission to use them in the study. Ten courses from each area were chosen. These were then evaluated for learning styles by a group of four individuals -- two educators, two professors -- who were first educated in the learning styles paradigm. The judgments were far from unanimous but the averages were taken for each outline and then each Faculty.

### Results

Although the Learning Styles questionnaire is appropriate for asking students and faculty about approaches to learning, the format of devoting percentages to each makes it difficult to perform statistical analyses on the results. When one percentage falls another rises, so the four numbers are not independent of each other. To avoid this problem, dominant student learning styles and strategies for each student were calculated separately by Gender (as this variable influences scores, see Brew, 2000) and by Faculty. Chi-square tests were conducted to see whether the distributions of these first choices were different from equal and then whether they were different by Faculty from the averages for all.

#### Dominant Student Learning Styles

Learning Styles of female students were strongly different from equal,  $\chi^2 (3) = 115.78$ ,  $p < 0.001$ . They were also different from equal across the Faculties,  $\chi^2 (3) = 24.2$ ,  $p < 0.001$ . These were due mainly to the preponderance of Doers, especially in Health Sciences but also in Sciences. The students in Humanities were notable even in their choices of favourite learning styles (Table 1). The differences were similar for males, though slightly less impressive. Their distribution differed from chance,  $\chi^2 (3) = 56.69$ ,  $p < 0.001$  and the members of different Faculties differed from each other,  $\chi^2 (3) = 15.43$ ,  $p < 0.005$ . Both Science students and those in Management were much more likely to be Doers and less likely to be Feelers, and the members of Humanities classes were also more evenly distributed (see Table 1).

### Dominant Student Learning Strategies

The pattern of differences in learning strategies was similar to that of learning styles except that the differences were more obvious for males. Female students' favourite learning strategies were not equally distributed,  $\chi^2 = 55.22$ ,  $p < 0.001$ . There tended to be more Convergers and fewer Divergers than by chance (Table 2). Again, their Strategies were somewhat different across Faculties,  $\chi^2 (3) = 24.22$ ,  $p < 0.001$ . There were more Assimilators and fewer Accomodators, except in Health Sciences. Male students' favourite learning strategies were far from equally distributed,  $\chi^2(3) = 95.68$ ,  $p < 0.001$ . There were many Convergers and few Divergers (see Table 2). They too differed across Faculties, with  $\chi^2 (3) < 30.1$ ,  $p < 0.001$ . There was an abundance of Convergers, primarily in Sciences and secondarily in Management.

### Professors vs. Students

Although statistical tests could not be made, when the amount of emphasis placed on each Learning Style and Strategy was evaluated within individuals and compared across students and professors course outlines some differences were easy to see (Table 3 & 4). For learning styles, professors' evaluations rarely asked for the Feeling dimension, ranging from a low of 0 for all 10 courses in the Sciences to a high of 11% in Health Sciences, even though their students used more of this Learning Style. Professors asked for far more Watching and Thinking in evaluation than students felt they used to approach learning. In Humanities, Health Science and Science, more Assimilators and Accomodators were expected by evaluative criteria than were shown by student opinions.

### Discussion

The most important finding of this study is that student learning styles are genuinely heterogeneous. For students this suggests that 'know thyself' is a useful mantra, as knowing one's own learning style and strategies can help in success in University (Dunn et al., 2001) and future careers (Kolb, 1999). Emphasizing feeling and an intuitive approach is not favoured for Science students, even though the commonly-used memorization and objective examinations are not particularly useful in generating scientific ideas (Sintonen, 2004). This emphasis was reflected especially by the predominance of Convergers in course outlines and male students' approach in the area. Contrary to gender stereotyping (Etkowitz et al., 2000),

however, many female Science students were also Convergers.

Students' knowledge of their learning styles may be of limited use in their classwork. Those in both Education and Engineering faculties (Hativa & Birenbaum, 2000) preferred a clear organized lecturing format for instruction by a wide margin over the second most popular one, a support-providing instruction style, and active self-regulating learning was their least appreciated teaching style. What teachers perceive to be most beneficial to students' 'deep learning' may not be what students want in instruction, but perhaps students are being realists in suiting teacher instruction to the evaluations they expect. Similarly, a Student Oriented Education project (Vermetten, Vermunt & Lodewijks, 2002) hoping to improve students deep-level and critical learning found that different groups of students within the classroom used assistance differently and in ways that suited their own learning habits, and that their learning did not often become more sophisticated. Finally, Cuthbert (2005) suggests that knowing one's own learning style is only useful if the teacher encourages the student to consider "the nature of learning...and how s/he deal with the process" (p. 246).

This lack of direction puts the onus for recognizing student learning style heterogeneity and finding ways to accommodate this variation squarely on the teacher. Yet teaching styles are not without influence either. Their cognitive and affective styles tend to dictate how teachers choose to educate and evaluate student teachers (Evans, 2004), and university professors (Yamagishi, 1990) tend to teach in a cognitive style that matches their own. As well, the general pedagogical environment may affect teaching, since many instructors in first year Chemistry and Physics tended to be student-centered in their teaching if they preferred that style, but taught more teacher-focused than they professed, perhaps affected by other faculty or student expectations (Richardson, 2005). Teachers with an understanding of students' approach to learning can better adjust their own methods appropriately and use several instructional and evaluative methods that match the variety they know students in their classrooms represent (Wolfe et al., 2006).

Although researchers advise a variety of instructional methods for this heterogeneous population, (Piane et al., 1996; Crews et al., 2000; Hativa & Birenbaum, 2000; Vermunt et al., 2004), standard advice for university teachers on how to teach (for example, McKeachie, 1995) may be only partially useful. While everyone realizes the variety, there is also a host of different measures and scales on which to assess it (see Cuthbert (2005) for evaluation of some of this diversity). One obvious teaching technique is to give a class several different types of assignments for evaluation so that those whose strategies are poorly matched to one assignment type nevertheless do better on another. A second approach is to have students working in groups; besides the obvious training for working with others (Loser, 2006), groups can tap the different abilities of several individuals to come up with solutions to problems. More (1993) has an interesting workbook, designed more for elementary and high school teachers, to help teachers evaluate student learning styles and plan steps that move this into classroom use. To truly educate the whole student population, university professors must be the leaders, not only in diversifying their teaching styles but in educating students to think about their learning and understand what

will be best for them to shape their future.

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 [Contents](#)

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